REMARKS/ARGUMENTS

This case has been carefully reviewed and analyzed in view of the Official Action dated 21 May 2003. Responsive to the rejections made in the Official Action, Claims 1 and 20 have been amended to clarify the combination of elements that define the invention of the subject Patent Application. Also, Claim 6 has been canceled without prejudice or disclaimer to introduce the subject matter thereof into Independent Claim 1.

In the Official Action, Claims 1-15 and 17-22 were rejected under 35 U.S.C. § 103 as being unpatentable over Liu, et al., U.S. Patent #5,176,723 in view of Lee, et al., U.S. Patent #6,506,345; and Claims 16 and 23 were rejected under 35 U.S.C. § 103 as being unpatentable over Liu, et al./Lee, et al. and further in view of Denton, et al., U.S. Patent #5,708,502.

Prior to consideration of the features regarded as the inventive elements of the present invention separating the latter from the prior art cited by the Examiner, a review of Liu, et al. Patent is in order. The Liu, et al. reference is directed to a condensation-growth particle scrubber which provides for the removal of sub-micron particles in gas stream. The gas stream is treated to permit very fine particles to coagulate through a short residence time in the conduit handling the gas stream, and thereafter is conditioned to establish saturation of the gas stream at a low temperature, such as by water injection. The saturated stream of gas containing the particles is then passed through a particle

growth chamber or section where steam is injected into the gas to establish a supersaturation condition, causing the particles in the gas stream to grow in size by water condensing around the particles. The particles are grown to a size that is near one micron, and are removed through conventional particulate removal devices. Specifically, the particulate removal device 42 can include an impactor. If desired, water can be injected into the particulate removal device 42 from a water source 44. Clean gas is discharged from the particulate removal device 42 along a conduit 46, and water carrying particulate materials is discharged along the conduit 48 for disposal. It is respectfully submitted that Liu, et al. fails to disclose, suggest, or render obvious the structure and method which the Applicant regards as the invention. Specifically,

a) Liu, et al., in contrast to the present invention, is a particle removal system which is not concerned with sampling particulate matter for near real time multi-element analysis, and therefore the output of this system does not represent a sample in the form of a slurry containing contaminating particles serving as samples for further multi-element analysis. The water carrying particulate materials is discharged along the conduit 48 for disposal (Column 4, Lines 54-56). Thus, Liu, et al. does not need to contemplate to include any kind of analyzer of the output water content.

In contrast to Liu, et al., the system and method of the present invention represent a technique for analysis of the samples which are collected on sub-hourly basis from ambient particulate matter at the input of the system so that the liquid slurry containing

large droplets of the contaminating particles is output from the system directly into a graphite furnace atomic absorption spectrometry device for analysis.

b) Since Liu, et al. is not concerned with the sampling and analysis of the particulate laden air, in Liu, et al.'s system, flow rates of the ambient air supplied to the input of the system are not of importance.

While in the present invention, which is in contrast to Liu, et al., is a system and method for collecting samples of the ambient particulate matter and supplying it for multi-element analysis, it is important to supply the ambient air to the input of the system at a high rate (not lower than 170 L/min) in order to collect sufficient amount of ambient air to provide collecting the samples on the sub-hourly basis.

With regard to flow rates, the Examiner stated in the Official Action that it would have been obvious to one of ordinary skill in the art to adjust the flow rate to optimize the system of Liu, et al. It is respectfully submitted that since Liu, et al. is not concerned with sampling and analysis of the ambient air, the reference not only fails to disclose flow rates of the entering ambient air, as well as output flow rates of the clean gas 46 and water 48 exiting from the particulate removal device 42, but any adjustment of these parameters in Liu, et al. cannot be considered as means for optimization of their system, since the flow rates are irrelevant to optimization of the system of Liu, et al.

While in the present invention, since it is designed particularly for collecting samples of the air and for analysis collected samples, the quantity of the matter collected

for the analysis is important, and therefore, the flow rate of the ambient air entering the system is of quite importance. The higher such a flow rate of the entering ambient air in the system, the shorter can be sampling time for collecting the samples of the ambient air.

Lee, et al.,. another reference cited by the Examiner, is directed to an apparatus for rapid measurement of aerosol bulk chemical compositions. The apparatus includes a modified particle size magnifier for producing activated aerosol particles and a collection device which collects the activated aerosol particles into a liquid stream for quantitative analysis by an analytical method. The method provides for on-line measurement of chemical composition of aerosol particles and includes exposing aerosol carrying sample air to hot saturated steam thereby forming activated aerosol particles; collecting the activated aerosol particles by a collection device for delivery as a jet stream into an impaction surface; flushing off the activated aerosol particles from the impaction surface into a liquid stream for delivery of the collected liquid stream to an analytical instrument for quantitative measurement.

It is respectfully submitted that Lee, et al. collects the samples of the air at the sample air flow rate 5 LPM (Column 5, Line 18), which is much lower than the flow rate of the ambient air entering the system of the present invention. The system of Lee, et al. is disadvantaged in comparison with the system of the present invention in that Lee, et al. collects the droplets by rinsing them from an impaction surface of the maximum impactor 16 with a flow of water this way diluting the sample at this point by a factor of

approximately 4. This step of the method described in Lee, et al. alone would severely hinder their ability to do multi-element analysis on their samples. Besides, since the system of Lee, et al. does not permit increased flow rate due to the lack of a concentrator in their system, they cannot possibly obtain sufficient quantity of the sample to permit multi-element analysis.

Absent from the Applicant's disclosure, there is no motivation for combining the apparatus for measurement of aerosol bulk chemical compositions of Lee, et al., which itself fails to provide high flow rate of the ambient air entering the system which would be suitable for near real time multi-element analysis, with a particle removal system of Liu, et al. which is not intended for element analysis but exclusively for the removal of sub-micron particle and gas stream, and which does not suggest or disclose collecting samples of the ambient particulate matter at elevated flow rates.

Denton, et al. cited by the Examiner is a random access charge transfer device for multi-element atomic absorption spectrometry but it does not relate to collecting samples of atmospheric aerosol particles in the system where a condensational growth of water vapor is used to grow fine particles by steam injection, wherein the grown droplets are concentrated using a virtual impactor, and then separated from the air stream using a real impactor, and wherein the particles are collected in a liquid slurry which is hydraulically delivered to the graphite furnace for atomic absorption spectrometry analysis. It is

believed that Denton, et al. has been cited as a prior art reference just merely for showing that the graphite furnace is applicable for atomic absorption spectrometry analysis.

Absent Applicant's disclosure, there is no motivation for combining the elements of Denton, et al. with particle removal system of Liu, et al., and/or with apparatus for rapid measurement of aerosol bulk chemical composition of Lee, et al. It can be only thought an improper use of hindsight, using Applicant's disclosure as a blueprint for the combination, that the Examiner suggests such a combination of references, Denton, et al., Lee, et al., and Liu, et al.

Arguendo, even if teachings of the cited references are combined, it is believed that the combination of elements of the invention of the subject Patent Application, as now claimed, still provides patentable distinction over the structure resulting from the Examiner's suggested combination. Indeed, none of the references cited by the Examiner, taken singly or in combination thereof, describes, suggests, or renders obvious a system and method for collecting sub-hourly ambient particulate matter samples at flow rates of 170 – 260 L/min suitable for near real time multi-element analysis. Claims 1 and 20 have been amended to clearly direct themselves to such a system and method for collecting samples of atmospheric aerosol particles for multi-element analysis where the flow rate of the ambient air entering the system is 170 – 260 L/min. Therefore, these Claims are believed to be patentably distinct over the cited prior art, taken singly or in

combination. Accordingly, Independent Claims 1 and 20, as amended, are believed to be allowable; and the same is respectfully urged.

Claim 6 has been canceled to introduce the subject matter thereof into Independent Claim 1. Claims 2-5, 7-19, and 21-22, dependent on Independent Claims 1 and 20 are believed each to add further limitations that are patentably distinct in addition to being dependent upon what is now believed to be a patentable base Claim, and therefore, allowable for at least the same reasons.

For all of the foregoing reasons, it is now believed that the subject Patent Application has been placed in condition for allowance, and such action is respectfully requested.

Respectfully submitted,

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